

Hydroclimatic Change Effects on Stormwater BMPs in Different Regions of the U.S.



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ACE Meet the Scientist – October 13, 2021



Climate Change and Water

Climate change presents a tangible risk to EPA's National Water Program (e.g., CWA and SDWA programs)

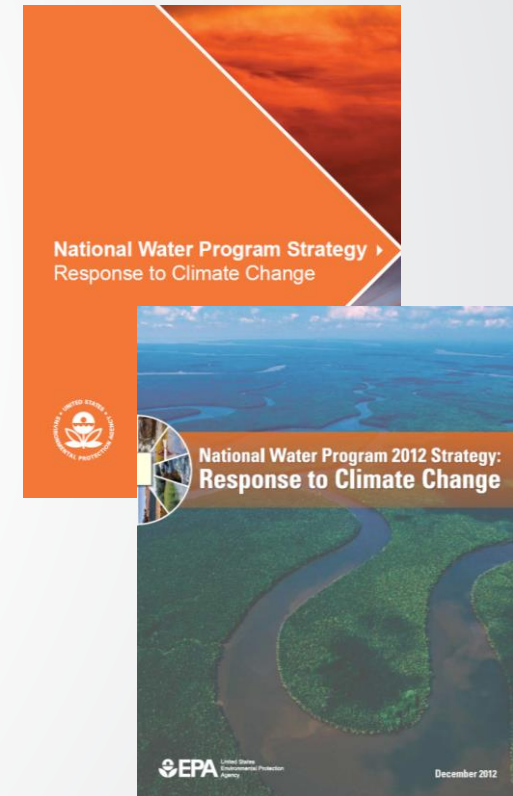
- EPA and State, Tribe and local partners need tools and information to anticipate and respond to potential impacts
- Impacts on water quality and aquatic ecosystems a particular concern to EPA

Research Goals:

- Identify potential hydrologic and water quality changes regionally across the U.S.
- Characterize risk and opportunities to increase the resilience of management responses (best management practices; BMPs)

Approach:

- Literature synthesis and assessment
- Using water models to assess system responses to climate change scenarios
- Methodological advances/approaches to support decision making





Towards Climate Smart BMPs

Many water quality BMPs work via mechanisms sensitive to changes in weather and climate (retention, filtration, biological uptake)

- Climate change can alter function; may require changes in how designed and implemented

Previous ACE modeling studies have demonstrated BMP sensitivity to climate change in urban, agricultural and forestry settings

Current product (ACE 6.3.2) is a national-scale screening of potential effects of hydroclimatic change on stormwater runoff and BMP sizing

- Based on projected changes in precipitation design storms
- 2500 sites; LOCA ensemble; SWMM stormwater model

Partners can use to:

- Identify range of future changes to which adaptation may be needed
- Target more detailed studies in high-risk regions





Selected Resources

BMP Resilience

- Butcher J. et al., 2021. An efficient statistical approach to develop IDF curves for precipitation and runoff under future climate. Climatic Change, 64(3). <https://doi.org/10.1007/s10584-021-02963-y>
- Coffey et al., 2020. Modeling the effects of future hydroclimatic conditions on microbial water quality and management practices in two agricultural watersheds. Trans. of the Amer. Soc. for Ag and Biol Engin., 63(3): 753-770. <https://doi.org/10.13031/trans.13630>
- Yonce et al., 2020. Forest riparian buffers can reduce timber harvesting effects on stream temperature under future conditions, but additional climate adaptation strategies are likely needed. Journal of Water and Climate Change. <https://doi.org/10.2166/wcc.2020.031>
- Schmidt et al., 2019. Agricultural best management practice sensitivity to changing air temperature and precipitation. Trans. of the Amer. Soc. for Ag and Biol Engin., 62(4): 1021-1033. <https://doi.org/10.13031/trans.13292>
- Sarkar et al. 2018. Simulated sensitivity of urban green infrastructure practices to climate change. Earth Interactions, 22(13)1-37. <https://doi.org/10.1175/EI-D-17-0015.1>

Literature Synthesis and Assessment

- Paul et al., 2018. A review of water quality responses to air temperature and precipitation changes 1: flow, water temperature, saltwater Intrusion. J. of the American Water Resources Association, 1–20. <https://doi.org/10.1111/1752-1688.12710>.
- Coffey et al., 2018. A review of water quality responses to air temperature and precipitation changes 2: nutrients, algal blooms, sediment, pathogens. J. of the American Water Resources Association, 1–25. <https://doi.org/10.1111/1752-1688.12711>.

Water Quality Changes / Assessment Methodology

- Johnson et al., 2016. Modeling streamflow and water quality sensitivity to climate change and urban development in 20 U.S. watersheds. J. of the American Water Resources Association, 51(5):1321-1341. <https://doi.org/10.1111/1752-1688.1230>
- Butcher et al., 2017. Estimating future temperature maxima in lakes across the United States using a surrogate modeling approach. PLoS ONE, 12(11): e0183499. <https://doi.org/10.1371/journal.pone.0183499>
- Fischbach et al., 2015. Managing Water Quality in the Face of Uncertainty: A Robust Decision Making Demonstration for EPA's National Water Program. https://www.rand.org/pubs/research_reports/RR720.html